

MANUFACTURING APPLICATIONS

COURSE DESCRIPTION

***Manufacturing Applications* is a 12th-grade course for students interested in entering the workforce or pursuing higher education in the manufacturing area. The course requires students to solve problems in a real-world manufacturing context. Problems address critical areas identified by industry and supported by relevant national standards.**

The course is structured as a series of simulation units. The simulations require students to identify problems in a manufacturing company based on data supplied in typical management reports. Students work in teams of four to six. Teams test and refine proposed solutions with computer simulations. All teams work on the same problem concurrently. At the end of each unit, students present team findings and recommendations to the class and to a panel of manufacturing industry representatives, which acts as the board of directors.

Prerequisite(s): Principles of Manufacturing, Principles of Machining and Manufacturing, or Principles of Engineering; Algebra I or Math for Technology II

Recommended Credits: 2

Recommended Grade Level(s): 12th

MANUFACTURING APPLICATIONS STANDARDS

- 1.0 Students will correlate human factors with economic and organizational outcomes in a manufacturing environment.
- 2.0 Students will determine factors that influence strategic technology and human resource decisions in manufacturing.
- 3.0 Students will assess the impact of safety practices in a manufacturing organization.
- 4.0 Students will correlate quality practices with business outcomes in manufacturing.
- 5.0 Students will obtain employment within the manufacturing industry using appropriate job-search strategies and interviewing behaviors.
- 6.0 Students will demonstrate leadership, citizenship, and teamwork skills required for success in the school, community, and workplace.

MANUFACTURING APPLICATIONS

STANDARD 1.0

Students will correlate human factors with economic and organizational outcomes in a manufacturing environment.

LEARNING EXPECTATIONS

The student will:

- 1.1 Analyze the effects of employee absenteeism on product cost and worker morale.
- 1.2 Analyze the relationship between productivity, profitability, and wages.
- 1.3 Resolve workplace ethical dilemmas.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

Given a simulated manufacturing scenario, the student:

- 1.1.A Calculates the effects of absenteeism on product cost.
- 1.1.B Describes implications of absenteeism for worker morale.
- 1.2.A Determines factors that influence the setting of employee wages.
- 1.2.B Correlates wage determination with productivity and profitability.
- 1.3.A Applies personal ethics to workplace decision-making.
- 1.3.B Makes workplace decisions based on values.

SAMPLE PERFORMANCE TASKS

- Students participate in a manufacturing simulation that requires them to identify effects of employee absenteeism on product cost and worker morale.
- Students participate in a manufacturing simulation that requires them to infer relationships between wages and business profit and productivity.
- Students participate in a manufacturing simulation that offers ethical dilemmas resulting from competing values in the workplace, such as co-worker loyalty versus reporting safety violations.

INTEGRATION/LINKAGES

Foundation for Industrial Modernization (FIM). *What Manufacturing Workers Need to Know and Be Able to Do: National Voluntary Skill Standards for Advanced High Performance Manufacturing*. Washington, DC: National Coalition for Advanced Manufacturing, 1995. International Technology Education Association. *Standards for Technological Literacy: Content for the Study of Technology*. International Technology Education Association. Reston, VA, 2000. Manufacturing Skill Standards Council. *A Blueprint for Workforce Excellence (draft skill standards for manufacturing.)* Manufacturing Skill Standards Council, 2001. Ford Academy of Manufacturing Sciences (FAMS curriculum). Business/Economics content.

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STANDARD 2.0

Students will determine factors that influence strategic technology and human resource decisions in manufacturing.

LEARNING EXPECTATIONS

The student will:

- 2.1 Investigate potential implications of technological innovations for manufacturing organizations.
- 2.2 Explore the short and long-term costs of and returns on human resource development.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

Given a simulated manufacturing scenario, the student:

- 2.1.A Makes strategic choices involving technological resources.
- 2.1.B Predicts the potential effects of strategic choices involving technological resources.
- 2.2.A Makes strategic choices involving human resources.
- 2.2.B Judges the economic value of employee development versus employee replacement.

SAMPLE PERFORMANCE TASKS

- Students participate in a manufacturing simulation that allows them to experience the trade-offs involved in making a decision to change manufacturing processes versus changing the workforce.
- Students participate in a manufacturing simulation that requires them to choose between upgrading the workforce through continuing education or replacing current workers and training new ones.

INTEGRATION/LINKAGES

Foundation for Industrial Modernization (FIM). *What Manufacturing Workers Need to Know and Be Able to Do: National Voluntary Skill Standards for Advanced High Performance Manufacturing*. Washington, DC: National Coalition for Advanced Manufacturing, 1995. International Technology Education Association. *Standards for Technological Literacy: Content for the Study of Technology*. International Technology Education Association. Reston, VA, 2000. Manufacturing Skill Standards Council. *A Blueprint for Workforce Excellence (draft skill standards for manufacturing.)* Manufacturing Skill Standards Council, 2001. Ford Academy of Manufacturing Sciences (FAMS curriculum). Project Lead the Way curriculum. Economics/Business content.

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STANDARD 3.0

Students will assess the impact of safety practices in a manufacturing organization.

LEARNING EXPECTATIONS

The student will:

- 3.1 Analyze safety practices and procedures.
- 3.2 Explore the role of manufacturing safety practices in an economic context.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

Given a simulated manufacturing scenario, the student:

- 3.1.A Locates and interprets reference materials related to safety practices.
- 3.1.B Recommends improvements in safety practices.
- 3.2.A Correlates safety practices with specific business outcomes.
- 3.2.B Predicts the effects of changes in safety practices on business outcomes.

SAMPLE PERFORMANCE TASKS

- Students participate in a manufacturing simulation that requires them to experience the relationship between safety practices, cost, and productivity (such as the impact of implementing a new safety procedure).

INTEGRATION/LINKAGES

Foundation for Industrial Modernization (FIM). *What Manufacturing Workers Need to Know and Be Able to Do: National Voluntary Skill Standards for Advanced High Performance Manufacturing*. Washington, DC: National Coalition for Advanced Manufacturing, 1995. International Technology Education Association. *Standards for Technological Literacy: Content for the Study of Technology*. International Technology Education Association. Reston, VA, 2000. Manufacturing Skill Standards Council. *A Blueprint for Workforce Excellence (draft skill standards for manufacturing.)* Manufacturing Skill Standards Council, 2001. Ford Academy of Manufacturing Sciences (FAMS curriculum). Project Lead the Way curriculum. Business/Economics content.

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STANDARD 4.0

Students will correlate quality practices with business outcomes in manufacturing.

LEARNING EXPECTATIONS

The student will:

- 4.1 Analyze the relationship between quality management practices and profitability.
- 4.2 Assess the effects of quality assurance on manufacturing processes.
- 4.3 Analyze the relationship between process management and quality assurance.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

Given a simulated manufacturing scenario, the student:

- 4.1.A Predicts the economic impact of quality management practices.
- 4.1.B Justifies the short-term costs of quality management based on long-term profitability.
- 4.2.A Infers the relationship between quality and customers.
- 4.2.B Defends the advantages of implementing quality assurance.
- 4.2.C Correlates quality with the critical success factors of an organization.
- 4.3.A Assesses advantages of process management.
- 4.3.B Justifies the need for feedback loops within a system.
- 4.3.C Devises modifications to a manufacturing process based on desired business outcomes.

SAMPLE PERFORMANCE TASKS

- Students participate in a manufacturing simulation that requires them to contrast the benefits and costs of quality management practices.

INTEGRATION/LINKAGES

Foundation for Industrial Modernization (FIM). *What Manufacturing Workers Need to Know and Be Able to Do: National Voluntary Skill Standards for Advanced High Performance Manufacturing*. Washington, DC: National Coalition for Advanced Manufacturing, 1995.
International Technology Education Association. *Standards for Technological Literacy: Content for the Study of Technology*. International Technology Education Association. Reston, VA, 2000.
Manufacturing Skill Standards Council. *A Blueprint for Workforce Excellence (draft skill standards for manufacturing.)* Manufacturing Skill Standards Council, 2001. Ford Academy of Manufacturing Sciences (FAMS curriculum). Project Lead the Way curriculum. Economics/Business/Quality content.

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STANDARD 5.0

Students will obtain employment within the manufacturing industry using appropriate job-search strategies and interviewing behaviors.

LEARNING EXPECTATIONS

The student will:

- 5.1 Develop job-search strategies.
- 5.2 Demonstrate appropriate interview and workplace dress and behavior.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 5.1.A Creates effective resumes.
- 5.1.B Performs job searches using the Internet and other resources.
- 5.1.C Completes standard employment application forms.
- 5.2.A Distinguishes between positive and negative interview behaviors.
- 5.2.B Models appropriate dress for an employment interview.
- 5.2.C Prepares appropriate responses to common interview questions.

SAMPLE PERFORMANCE TASKS

- Students prepare resumes based on their assigned roles in the simulations. At the end of the school year, students and/or an Industry Board evaluate candidates for hypothetical job openings, based on the resumes and mock interviews.

INTEGRATION/LINKAGES

Foundation for Industrial Modernization (FIM). *What Manufacturing Workers Need to Know and Be Able to Do: National Voluntary Skill Standards for Advanced High Performance Manufacturing*. Washington, DC: National Coalition for Advanced Manufacturing, 1995.
International Technology Education Association. *Standards for Technological Literacy: Content for the Study of Technology*. International Technology Education Association. Reston, VA, 2000.
Manufacturing Skill Standards Council. *A Blueprint for Workforce Excellence (draft skill standards for manufacturing.)* Manufacturing Skill Standards Council, 2001.
Career/Communications content.

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STANDARD 6.0

Students will demonstrate leadership, citizenship, and teamwork skills required for success in the school, community, and workplace.

LEARNING EXPECTATIONS

The student will:

- 6.1 Analyze the function of fairness, integrity, and loyalty in work.
- 6.2 Illustrate how a “mind set” can block communication.
- 6.3 Evaluate personal interest and tolerance levels for working on a team.
- 6.4 Establish a positive climate and spirit of cooperation among individuals who are working together on a project.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 6.1.A Identifies self-imposed barriers that enhance self-image.
- 6.1.B Demonstrate fairness, integrity, and loyalty in work.
- 6.2. Identifies barriers that cause problems in interpersonal communications.
- 6.3.A Completes a self-assessment to clarify values and creates a baseline for team attitude building.
- 6.3.B Evaluates raw data from self-assessment and determines personal values that are needed to work in teams.
- 6.4.A Illustrates in a group activity attitudes or items that directly or indirectly influence the climate of the work place.
- 6.4.B Integrates the purposes of SkillsUSA-VICA into the work environment.

SAMPLE PERFORMANCE TASKS

- Researches the Internet to locate biographical information on individuals in the manufacturing industry and charts personality characteristics.
- Present a report to the total group on “How to Develop a Positive Workplace Climate.”
- Develop a plan for continuing education in the manufacturing industry.
- Create a chart showing personal mind-sets that will effect personal growth positive and negative.
- Participate in various SkillsUSA-VICA programs and/or competitive events.
- Interview individuals in the manufacturing industry that work in teams.
- Participate in the American Spirit Award competition with SkillsUSA-VICA.
- Participate in job shadowing or internship within the manufacturing industry.

INTEGRATION /LINKAGES

SkillsUSA-VICA, *Professional Development Program*, SkillsUSA-VICA, Communications and Writing Skills, Teambuilding Skills, Research, Language Arts, Sociology, Psychology, Math, Math for Technology, Applied Communications, Social Studies, Problem Solving, Interpersonal Skills, Employability Skills, Critical-Thinking Skills, Secretary's Commission on Achieving Necessary Skills (SCANS), Chamber of Commerce, Colleges, Universities, Technology Centers, and Employment Agencies, *Total Quality Management*, SkillsUSA-VICA

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SAMPLING OF AVAILABLE RESOURCES

Principles of Engineering Economy, 8th Edition. John Wiley & Sons. 1990.
Contemporary Engineering Economics. Addison-Wesley Publishing Co., January 1997.
Modern Engineering Economy. John Wiley & Sons, 1993.
Introduction to Business: Our Business and Economic World. Glencoe, 1997.
Introduction to Business, 4th Edition. South-Western Educational Publishing, 2000.
Quick Skills series. South-Western Educational Publishing, 2001.
Succeeding in the World of Work. Glencoe, 1998.
SCANS 2000 Virtual Workplace Simulations. South-Western Educational Publishing /Johns Hopkins University, 2000.

Simulation software resources

(For reference only. Inclusion in this list does not imply endorsement of any product).

ALPHA/Sim®

ALPHATECH, Inc.

www.alphatech.com/alphasim/

AutoMod

by Brooks Automation

www.autosim.com

Deneb/QUEST®

Delmia

www.deneb.com/products/quest.html

Extend+Manufacturing

Imagine That, Inc.

www.imaginethatinc.com/pages/mfg.html

Factory Explorer®

Wright Williams & Kelly

www.wwk.com/fxflier.html

MAST Simulation Environment

CMS Research, Inc.

www.powernetonline.com/~cmsres/mast.htm

Micro Saint

Micro Analysis and Design, Inc.

www.maad.com/MaadWeb/microsaint/msaintma.htm

ProModel®

ProModel Corp.

www.promodel.com/products/promodel/

Rapid Response Manufacturing®

ProfitKey International
www.profitkey.com/rrm.htm

Resource Manager for Excel
User Solutions, Inc.
www.usersolutions.com/products.html

SimCAD Pro
by CreateASoft
www.createasoft.com/

SIMUL8
SIMUL8 Corp.
www.simul8.com/edu4.htm

SyteLine® and SyteCentre®
Frontstep, Inc.
www.frontstep.com/solutions/enterprisemanagement/index.html

Taylor ED
Enterprise Dynamics Corp.
204.250.198.120/software.html

Virtual Factory
EAI
www.eai.com/solutions/VF/overview.html